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Age and Size Composition of the Menhaden Catch Along the Atlantic Coast of the United States, 1961

With a Brief Review of the Commercial Fishery

by William R. Nicholson and Joseph R. Higham, Jr.

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UNITED STATES DEPARTMENT OF THE INTERIOR
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ABSTRACT

The major features of the 1961 purse seine fishery for Atlantic menhaden, Brevoortia tyrannus, are summarized and briefly discussed. The catch in the summer fishery (May to October) was 541,000 tons, 32,000 tons less than the mean for the period 1955-60; in the North Carolina fall fishery (November to January), 78,000 tons, 3,000 tons more than the mean for the same period. An estimated 26,344 purse seine sets were made in the summer fishery and 1,258 in the fall fishery. The catch per purse seine set was 21 tons in the summer fishery and 62 tons in the fall fishery. Age-3 fish (1958 year class) furnished the largest number of fish in the catch and the greatest percentage of the catch by weight. Age-1 and age-2 fish were generally larger, and age-3 fish generally smaller, than in previous years, while age-4 and older fish were generally of the same size.

INTRODUCTION

Purse seine catches of Atlantic menhaden, Brevoortia tyrannus, along the Atlantic coast of the United States are sampled each year for age, size, and sex composition. Data also are collected on other aspects of the fishery, including the number of vessels employed, the distribution of fishing, and important changes that occur. Since the inception of this work by the Bureau of Commercial Fisheries in 1955, the results have been summarized and discussed briefly in a series of annual reports. This report, the seventh in the series, covers the 1961 purse seine fishery and includes comparable data from other years. As in previous reports, the data for the summer fishery are summarized and reviewed by four geographical areas (fig. 1); the North Carolina fall fishery is treated separately.

THE 1961 PURSE SEINE FISHERY

The purse seine catch in 1961 was 619,000 tons, 28,000 tons less than the 6-year mean, 1955-60. In the summer fishery (May to October), 541,000 tons were landed; in the North Carolina fall fishery (November to January), 78,000 tons (table 1). The summer catch in all areas was below the 6-year mean, but the fall catch off North Carolina was above the 6-year mean. The largest percentage of the catch was taken in the Middle Atlantic Area (50 percent), the smallest in the South Atlantic Area (8 percent).

An estimated 27,602 sets were made in 1961, 26,344 in the summer fishery and 1,258 in the fall fishery. The number was approximately 2 percent smaller than the 6-year mean in the summer fishery, and approximately 35 percent smaller in the North Carolina fall fishery.

The catch per purse seine set in the summer fishery was 21 tons, identical with the 6-year mean; in the North Carolina fall fishery it was 62 tons, 24 tons greater than the mean and 13 tons greater than the previous record of 49 tons per set in 1960.

South Atlantic Area

Three vessels fished from Fernandina Beach, Fla. The first landing was made on March 30. Until May 15, all catches were made between Jacksonville Beach and Fernandina Beach, Fla. From May 17 to June 20, nearly all landings were made between St. Catherines and Sapelo Sounds, Ga. From June 22 until fishing stopped on November 2, fishing again was concentrated

Note.--William R. Nicholson and Joseph R. Higham, Jr., Fishery Biologists (Research), Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N.C.

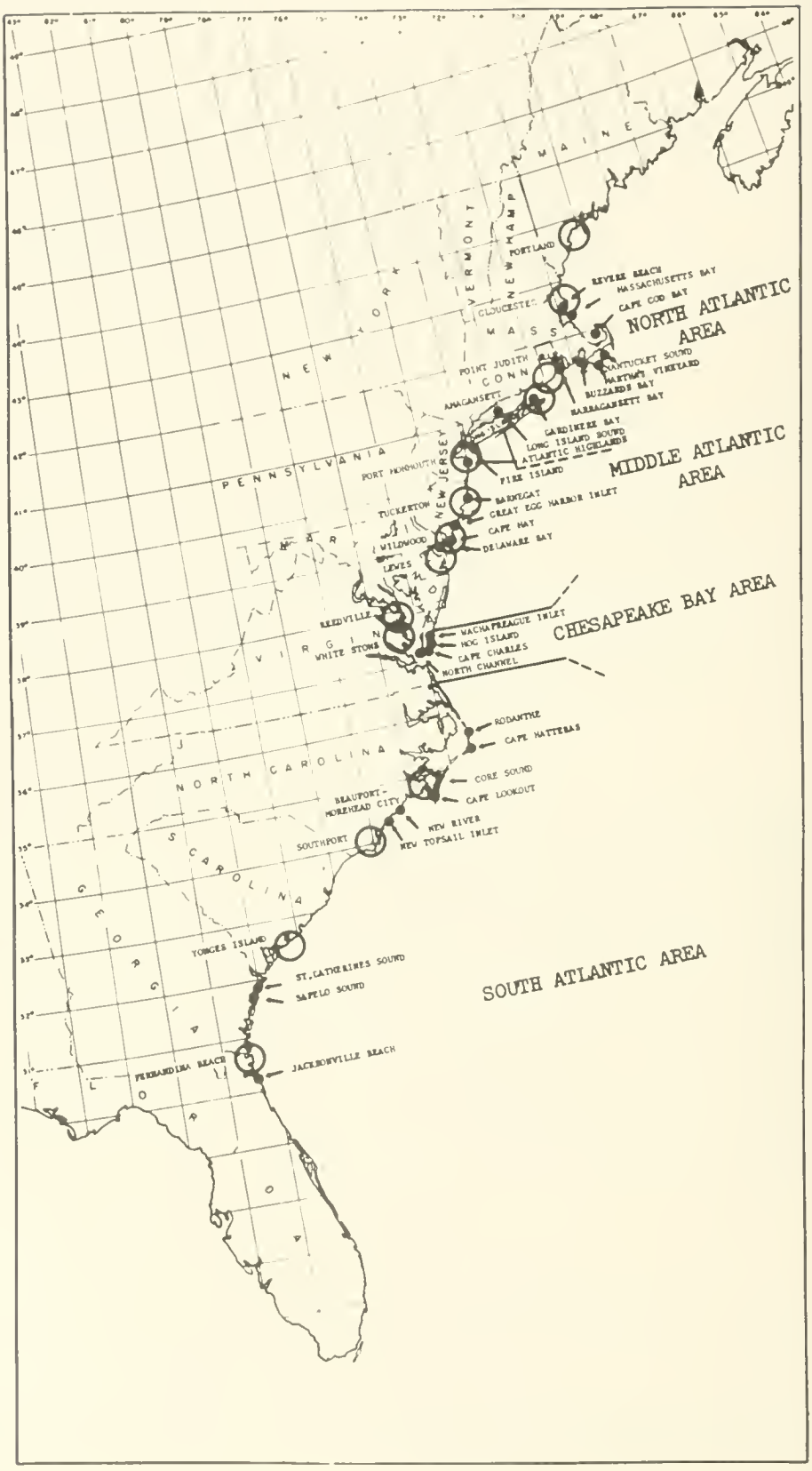

Figure 1.--Map showing location of places mentioned in the text, menhaden reduction plants, and areas used in summarizing Atlantic menhaden catch data.

Table 1.--Mean annual catch, mean number of purse seine sets, and mean catch per set, 1955-60; and the catch, number of sets, and catch per set, 1961, Atlantic menhaden purse seine fishery

Season and area	Catch		Purse seine sets[1]		Mean catch per purse seine set	
	Mean 1955-60	1961[2]	Mean 1955-60	1961	Mean 1955-60	1961
SUMMER FISHERY	Thousand tons	Thousand tons	Number	Number	Tons	Tons
South Atlantic....	53	49	3,183	2,450	17	20
Chesapeake Bay....	136	130	7,836	7,647	17	17
Middle Atlantic...	312	307	12,945	13,955	24	22
North Atlantic....	70	55	2,591	2,292	27	24
Total.....	571	541	26,612	26,344	21	21
FALL FISHERY						
North Carolina....	75	78[3]	1,943	1,258	38	62
Grand total.....	646	619	28,517	27,602	23	22

[1] Slight discrepancies in numbers as given in previous reports and in subtotals and totals are due to rounding off of figures.

[2] Source: Fishery statistics of the United States, 1961, by Edward A. Power, U. S. Fish and Wildlife Service, Statistical Digest No. 54.

[3] The North Carolina fall fishery normally extends into January; therefore, catch total includes January 1962, but not January 1961. Seasonal breakdown of the catch was obtained from U. S. Fish and Wildlife Service, C.F.S. Nos. 2521 and 2835.

between Jacksonville Beach and Fernandina Beach, with only occasional catches being made as far north as St. Catherines Sound.

Four vessels from Southport, N.C., commenced fishing on May 17. Three more joined the fleet on May 24, and another on May 29. Fishing was good through the first week in July. From then until August 9, landings were made only during the week of July 24. Fishing was poor through August, improved in September, but declined again in October. The last landing was made on October 24.

Six vessels from Beaufort, N.C., began fishing in Core Sound on May 10. One vessel began fishing in the ocean on May 16, and two others on May 24. Good fishing continued in outside waters until June 7, but few catches were made through the rest of the season. Fishing in inside waters, mostly in Core Sound, continued good through the middle of August. Catches in late August and September were poor, and only sporadic landings were made in October. Fishing terminated on November 2.

The catch in the South Atlantic Area was 49,000 tons. June ranked first in production (23 percent), followed by September (22 percent), May (17 percent), July (15 percent), August (13 percent), April (5 percent), and October (5 percent).

Chesapeake Bay Area

Fishing began on May 29, when 20 vessels made fair catches in the vicinity of North Channel. Two more vessels joined the fleet on June 1. Although schools were found throughout the bay during most of the summer, they

were concentrated in the lower part and in waters just outside the mouth. Approximately 85 percent of the catch was from these localities. Fishing terminated on November 6.

The purse seine catch was 130,000 tons, 18,000 tons greater than the 1960 catch, but 64,000 tons less than the record 1959 catch. July landings accounted for 28 percent of the catch, while June, September, August, October, and May accounted for 25, 18, 16, 9, and 4 percent, respectively.

Middle Atlantic Area

Fishing began on May 16, when two vessels from Lewes, Del., made catches off Hog Island, Va. By May 31, the fleet comprised 21 boats from Lewes, 7 from Wildwood, N.J., 6 from Tuckerton, N.J., and 10 from Port Monmouth, N.J.

Fishing was good during May and early June, large catches being made off the New Jersey coast from Cape May to Atlantic Highlands. Particularly dense concentrations of fish occurred in the vicinity of Great Egg Harbor Inlet. By the middle of June, fish became less plentiful off the New Jersey coast, and Lewes and Wildwood vessels shifted to Delaware Bay and southward to Wachapreague Inlet, Va. Except for short periods when fish disappeared from some localities, fishing through July and August was good from Delaware Bay to Atlantic Highlands, N.J. In September, fish became relatively scarce and bad weather hindered fishing. Schools of large fish appeared in October off the southern Long Island coast, and fair catches were made until the season ended on October 19.

The purse seine catch was 307,000 tons, 5,000 tons less than the mean for 1955-60. July landings accounted for 33 percent of the seasons catch, followed by August (26 percent), June (18 percent), September (12 percent), May (6 percent), and October (5 percent).

North Atlantic Area

Five vessels constituted the Point Judith, R.I., fleet in 1961. One vessel began fishing on May 24, two during the week of June 1, one on June 21, and another on July 18. Except for two catches on July 6 and two on September 2 from Nantucket Sound, Mass., all fishing through September 10 was conducted in Narragansett Bay, R.I. Fishing from September 11 to 18 was confined to the vicinity of Buzzards Bay, Mass. No catches were made during the remainder of the month. Sporadic catches were made in Gardiners Bay, N.Y., from October 1 to 11.

Five vessels, constituting the fleet from Gloucester, Mass., fished intermittently from June 13 to September 2. From June 13 to 18, fair catches were taken from Narragansett Bay. Although spotter pilots reported fish plentiful on the south shore of Nantucket Island, Mass., on June 23, bad weather prevented fishing. From June 24 to 26, however, two vessels made good catches in this area. Except during the week of July 19, when three vessels landed fish from Buzzards Bay, no catches were made from June 27 to August 14. From then until fishing terminated on September 2, occasional catches were made in Buzzards Bay and off Revere Beach and Martha's Vineyard, Mass.

Ten vessels from Amagansett, N.Y., commenced fishing on June 5. Most of the catch during June was taken from Narragansett Bay. During July and August good catches were made in Long Island and Nantucket Sounds, in Narragansett Bay, and off the southern shore of Long Island, N.Y., as far east as Fire Island. Fish became scarce in September, and during the last half of the month northeast storms and hurricane "Esther" hampered fishing. Catches during the month were poor, and nearly all were made in Long Island and Nantucket Sounds. Fish appeared off the southern shore of western Long Island in early October, and good catches were made until October 5. The fleet then shifted to the western end of Long Island Sound, where fish were relatively plentiful. The boats followed these fish as they moved eastward and finally disappeared in the vicinity of Gardiners Island, N.Y., on October 13. From October 17 to October 20, when fishing stopped, scattered catches were made from Gardiners Bay to Barnegat, N.J.

The catch in the North Atlantic was 55,000 tons, 15,000 tons less than the mean for 1955-60. August ranked first in percentage of the season's catch (36 percent), followed by July (28 percent), September (14 percent), June (13 percent), and October (9 percent).

North Carolina Fall Fishery

The fall fishery began November 13 and ended January 9, 1962. Forty-one vessels were engaged in the fishery. Until November 21, nearly all fishing was done between Cape Lookout and Cape Hatteras, with only small fish being caught. Large fish were spotted off Rodanthe on November 17 and off Cape Hatteras on November 20, but rough seas prevented fishing. On November 21, large fish were caught off New Topsail Inlet. For the next 5 weeks, large fish were plentiful between Cape Hatteras and New River, and good catches were made when weather permitted. During the first part of the season, most schools occurred within 8 miles of shore, in contrast to other years when they were found up to 20 miles or more offshore. Large numbers of fish, easy accessibility of the schools, and good weather combined to give nearly all boats record catches. The catch was 78,000 tons, 3,000 tons more than

the mean for 1955-60. Forty-five percent of the catch was landed in November, 54 percent in December, and 1 percent in January.

Distribution of Purse Seine Sets

The estimated numbers of purse seine sets within 10-minute unit areas are shown in figure 2. As in previous years, nearly all sets were made within the 20-fathom contour, between lat. 30° N. and 42° N., and the greatest amount of fishing occurred in Chesapeake Bay and in coastal waters from Cape Charles, Va., to Long Island, N.Y.

A major change from previous years was the almost complete absence of fishing north of Cape Cod. With the exception of approximately 15 sets in Massachusetts Bay, all sets in this locality were restricted to the southernmost waters in Cape Cod Bay. It was noted in the report for 1960 (Nicholson and Higham, 1964) that north of Massachusetts Bay fishing had been decreasing since 1956 and did not occur at all in 1960.

SAMPLING OF THE CATCH

The numbers of samples taken at various plant locations during the 1961 purse seine season are given in table 2. In the summer fishery, one sample was taken for every 888 tons of fish landed; in the fall fishery, one sample was taken for every 1,099 tons. Sampling procedures were the same as described in the first report in this series (June and Reintjes, 1959).

Age Composition

The percentage age composition and the calculated number of fish in each age group for each year, 1955-61, are shown in table 3.

For the third consecutive year, the 1958 year class dominated the catch. As age-3 fish in 1961, it furnished 48 percent of the purse seine catch, or approximately 1.3 billion fish. This was the largest percentage and greatest number of fish contributed by age-3 fish in the 7-year period. The combined contribution of age-4 and older fish (55.9 million) was lower than in any year except 1958. Age-2 fish (1959 year class) and age-1 fish (1960 year class) contributed, respectively, 524.3 million and 832.2 million fish. For these two age groups, the total number of fish (1,356.5 million) and the percentage of the catch (50 percent) were less than in any previous year. Age-0 fish contributed the smallest number of fish (0.25 million) and the smallest percentage (0.01) of any year in the period.

For the different areas, the percentage composition of the catches is shown in figure 3 and listed in table 4; the calculated number of fish in the different age groups is listed in table 5.

Although the catch in the South Atlantic Area included a greater number (57.7 million) and a greater percentage (9 percent) of age-3 fish (1958 year class) than in any previous year, it was dominated by fish of younger age groups. Age-1 fish contributed 506.2 million fish (79 percent) and age-2 fish 81 million (12 percent). The total number of fish caught (644.6 million) was greater than in 1960, when age-2 fish constituted most of the catch, but only about half of the number landed in either 1956 or 1959, when age-1 fish of exceptionally strong year classes dominated the catches.

For the first time since records were available, fish older than age 2 contributed a substantial part of the catch in the Chesapeake Bay Area. Age-3 fish furnished 28 percent of the catch (the largest previous percentage was 2 percent); age-2, 29 percent; and age-1, 44 percent. The total number of fish caught (716.6 million) was less than 1 billion for the second consecutive year and was the smallest catch in the 7 years of recorded data.

In the Middle Atlantic Area, age-3 fish dominated the fishery for the first time in the 7-year period, contributing 831.8 million fish and accounting for 80 percent of the catch. Only 187.6 million age-2 fish (18 percent of the catch) and 3.6 million age-1 fish (less than 1 percent of the catch) were caught. This is the smallest number caught for either of these two age groups during this 7-year period. Fish older than age 3 contributed 13.0 million fish, or 1.25 percent of the catch. Despite the relatively small number of younger fish, the total number of fish caught was again over 1 billion.

In the North Atlantic Area, age-1 fish were absent from the catches for the second consecutive year. Age-2 fish accounted for only 3 percent of the catch, in contrast to 45 percent in 1960, and their number was less than in any of the previous 6 years except 1955. Age-3 fish accounted for 80 percent of the catch. Their number in the catch (118 million) was greater than the number of age-3 fish caught in any of the previous 6 years. Fish older than age 3 accounted for only 25.8 million fish, or 17 percent of the catch, the smallest number except for 1958 and the smallest percentage except for 1959.

In the North Carolina fall fishery, age-3 fish also constituted the most abundant age group, accounting for 58 percent of the catch. Age-0 fish furnished less than 1 percent of the catch, or 0.25 million fish, the smallest catch of age-0 fish during this period. Except for 1955 and 1958, more age-2 fish were caught than

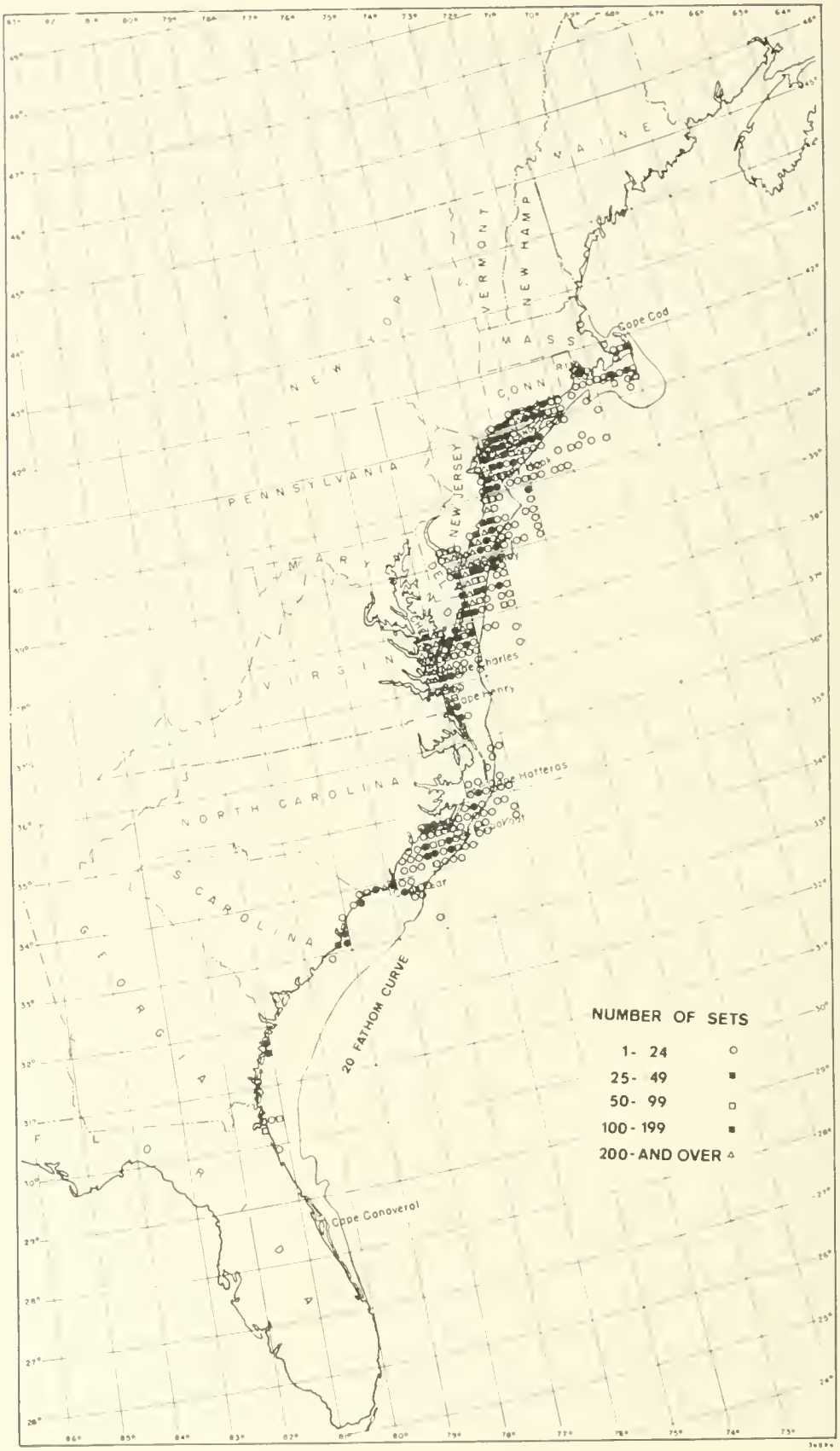

Figure 2.--Distribution of purse seine sets for Atlantic menhaden, 1961.

Table 2.--Number of samples of Atlantic menhaden taken from purse seine catches, by season and locality, 1961

Season and locality	Samples
SUMMER FISHERY	Number
Fernandina Beach, Fla.....	19
Southport, N.C.....	16
Beaufort, N.C.....	32
Reedville, Va.....	118
Lewes, Del.....	148
Wildwood, N.J.....	1
Port Monmouth, N.J.....	137
Amagansett, N.Y.....	130
Point Judith, R.I.....	8
Subtotal.....	609
FALL FISHERY	
Beaufort-Morehead City, N.C...	71
Total.....	680

in any previous year, and except for 1958 their percentage of the catch was larger. The number of fish in the catch older than age 3 was smaller than in any of the 6 previous years, and the percentage of these fish in the catch was smaller than in any year except 1958.

Length Composition

The percentage length distribution of fish in the samples from purse seine catches are shown, by area, in figure 4 (also see appendix tables 1-5).

The length-frequency distribution of fish caught in the South Atlantic Area was bimodal and ranged from 82 to 272 mm., but there were only a few fish greater than 225 mm. Modal lengths were 172 mm. for age-1 fish, 192 for age-2 fish, and 202 for age-3 fish. There was considerable overlapping in lengths of the two older age groups. Fish of all age groups were smaller than in other areas.

Although the length-frequency distribution of fish from the Chesapeake Bay Area was similar to that of fish from the South Atlantic Area, the lengths in the former area were greater (157-297 mm.). The modal length was 197 mm. for age 1, 232 mm. for age 2, and 242 mm. for age 3. There was only a small difference in length between ages 2 and 3.

In the Middle Atlantic Area, the frequency distribution was unimodal and composed primarily of two age groups. The length distribution of age-2 fish nearly overlapped that of the larger age-3 fish.

The length-frequency distribution in the North Atlantic Area also was unimodal and symmetrical and was composed primarily of age-3 and older fish. Lengths ranged from 232 to 347 mm.

The lengths of fish taken in the North Carolina fall fishery ranged from 132 to 342 mm., with a principal mode at 262 mm. Nearly all fish less than 222 mm. were age 1 or age 0. The lengths of age-2 fish almost completely overlapped those of age-3 fish.

As usual, females were larger than the males in most areas, the difference in length being greater among the older, larger fish found in the North Atlantic Area and the North Carolina fall fishery (fig. 5). There was no significant change from previous years in the sex ratio (table 6).

Weight Composition

The weight-frequency distributions (in percent) of fish in samples from purse seine catches are shown, by area, in figure 6 (also see appendix tables 6-11). While the distributions in the South Atlantic and Chesapeake Bay Areas were bimodal, those in the Middle and North Atlantic Areas were unimodal, due to the preponderance of fish of the dominant 1958 year class (age 3). As was usual for fish in the North Carolina fall fishery, where the catch comprised all age and size classes, the range in weights was large and the distribution bimodal. The positive skew of all distributions reflected the disproportionate number of older and larger fish in the catches.

Mean Length and Weight

The mean of the mean lengths and weights of Atlantic menhaden for the 6-year period, 1955-60, and the mean fork lengths and weights for 1961 are summarized in tables 7 and 8; the mean lengths and weights of each age group in the 1961 catches, by sex, are given in appendix tables 11-15.

Except for the North Carolina fall fishery, the mean length and the mean weight for the combined age groups in 1961 were either unchanged or were greater than those for the 6-year period. The increases were due to the unusually large numbers of age-3 fish and the unusually small numbers of age-1 and -2 fish in the catches.

While the means for fish older than age 3 in 1961 were not consistently different from the means for the preceding 6-year period, the means of age-3 fish were generally smaller and the means of age-1 and -2 fish generally larger than the means for the same period. These differences probably reflect the slower

Table 3.--Age composition (in percent) and calculated number of Atlantic menhaden (in millions) at each age in purse seine catches, 1955-61

(Most numerous age group underscored)

Year	AGE									
	0	1	2	3	4	5	6	7	8-10	Total
Age composition:										
1955.....	24.71	20.68	34.21	8.73	10.01	1.23	0.35	0.06	0.02	100.00
1956.....	1.00	57.16	25.97	9.61	1.26	4.18	0.67	0.12	0.02	99.99
1957.....	8.46	41.97	41.00	3.26	2.52	1.40	1.22	0.12	0.04	99.99
1958.....	3.81	30.85	60.93	2.72	0.62	0.56	0.32	0.17	0.07	99.98
1959.....	0.21	74.69	16.27	7.58	0.67	0.22	0.24	0.08	0.03	99.99
1960.....	2.47	16.98	72.78	2.77	3.72	0.86	0.31	0.08	0.03	100.00
1961.....	0.01	30.60	19.28	48.06	0.76	1.15	0.11	0.02	0.01	100.00
Number of fish:										
1955.....	761.01	636.86	1,053.47	268.87	308.21	37.95	10.75	1.88	0.59	3,079.59
1956.....	36.37	2,072.95	941.71	348.42	45.60	151.49	24.38	4.47	0.88	3,626.27
1957.....	300.77	1,491.13	1,456.63	115.96	89.72	49.66	43.43	4.34	1.27	3,552.91
1958.....	106.06	858.29	1,694.99	75.75	17.31	15.61	9.01	4.69	0.10	2,781.81
1959.....	11.40	4,120.10	897.34	418.42	37.15	12.35	13.06	4.71	1.82	5,516.35
1960.....	72.17	495.82	2,125.45	80.85	108.63	25.26	9.07	2.48	0.68	2,920.41
1961.....	0.25	832.25	524.30	1,307.34	20.73	31.42	2.95	0.51	0.26	2,720.01

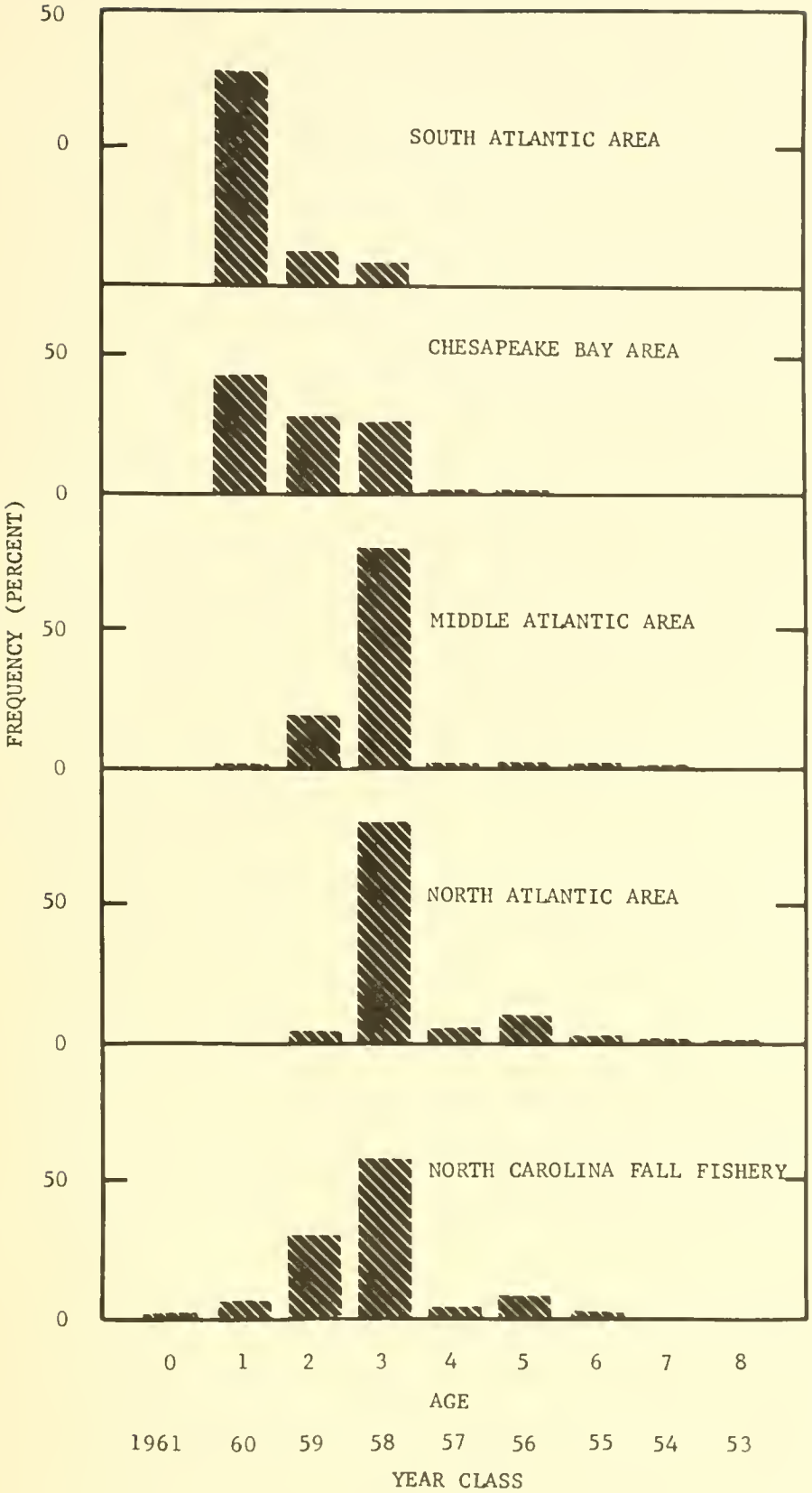

Figure 3.--Age composition of Atlantic menhaden in samples from purse seine catches, 1961.

Table 4.--Age composition (in percent) of Atlantic menhaden purse seine catches, by area and season, 1955-61

(Most numerous age group underscored)

Season, area, and year	AGE								
	0	1	2	3	4	5	6	7	8-10
SUMMER FISHERY									
South Atlantic:									
1955.....	1.66	65.22	27.02	3.32	2.77	--	--	--	--
1956.....	--	98.98	0.94	0.05	0.02	--	--	--	--
1957.....	3.65	32.47	63.76	0.12	--	--	--	--	--
1958.....	0.32	68.44	29.40	1.79	0.06	--	--	--	--
1959.....	--	90.90	8.95	0.15	--	--	--	--	--
1960.....	3.47	28.00	68.53	--	--	--	--	--	--
1961.....	--	78.52	12.49	8.94	0.05	--	--	--	--
Chesapeake Bay:									
1955.....	1.63	44.77	51.30	1.54	0.69	0.06	--	--	--
1956.....	--	90.91	9.02	0.07	--	--	--	--	--
1957.....	0.25	85.22	14.25	0.26	0.02	0.01	--	--	--
1958.....	0.04	46.32	53.01	0.50	0.08	0.04	--	--	--
1959.....	0.47	90.12	8.76	0.65	--	--	--	--	--
1960.....	--	17.55	82.12	0.33	--	--	--	--	--
1961.....	--	43.50	28.80	27.63	0.04	0.02	--	--	--
Middle Atlantic:									
1955.....	--	1.81	55.79	23.18	17.43	1.40	0.26	0.10	0.01
1956.....	--	14.78	63.96	18.08	1.44	1.41	0.26	0.06	0.01
1957.....	--	22.24	68.51	4.26	2.62	1.26	1.02	0.03	0.05
1958.....	--	2.54	95.08	2.21	0.12	0.03	0.02	--	--
1959.....	--	57.94	30.27	11.31	0.30	0.06	0.07	0.04	--
1960.....	--	1.01	95.29	1.24	1.82	0.41	0.17	0.04	0.02
1961.....	--	0.35	18.11	80.29	0.59	0.55	0.08	0.02	0.01
North Atlantic:									
1955.....	--	--	0.25	13.94	67.55	12.84	4.65	0.54	0.22
1956.....	--	--	6.41	36.35	8.22	40.96	6.42	1.29	0.36
1957.....	--	0.91	45.00	18.79	16.06	8.59	8.95	1.46	0.24
1958.....	--	0.16	52.58	24.47	8.43	6.75	5.13	2.36	0.11
1959.....	--	4.62	21.13	57.90	7.56	3.11	3.20	1.77	0.71
1960.....	--	--	44.92	21.39	26.93	4.90	1.48	0.36	0.01
1961.....	--	--	3.10	79.55	5.53	10.49	1.01	0.22	0.10
FALL FISHERY									
North Carolina:									
1955.....	87.19	3.61	6.00	0.86	1.96	0.32	0.04	--	0.01
1956.....	16.12	26.78	11.95	16.61	4.15	20.61	3.31	0.46	--
1957.....	74.20	3.24	6.08	4.07	5.40	3.84	2.89	0.25	0.02
1958.....	38.07	10.73	35.86	7.18	2.63	3.14	1.48	0.91	--
1959.....	0.39	3.84	20.11	58.00	10.30	3.21	3.40	0.44	0.30
1960.....	31.37	7.70	20.86	12.18	18.92	5.87	2.17	0.71	0.22
1961.....	0.14	6.14	25.90	58.43	3.30	5.73	0.35	--	--

Table 5.--Calculated number of Atlantic menhaden (in millions) in purse seine catches, by age, season, and area, 1955-61

(Most numerous age group underscored)

Season, area, and year	AGE									Total
	0	1	2	3	4	5	6	7	8-10	
SUMMER FISHERY										
South Atlantic:										
1955	6.51	255.20	105.74	13.01	10.83	--	--	--	--	391.29
1956	--	1,147.88	10.91	0.63	0.23	0.02	--	--	--	1,159.67
1957	13.27	117.91	231.56	0.42	--	--	--	--	--	363.16
1958	1.47	315.20	135.39	8.25	0.26	--	--	--	--	460.57
1959	--	1,051.86	103.53	1.72	--	--	--	--	--	1,157.11
1960	13.86	111.84	273.73	--	--	--	--	--	--	399.43
1961	--	506.20	80.51	57.65	0.30	--	--	--	--	644.66
Chesapeake Bay:										
1955	12.18	334.24	382.92	11.52	5.17	0.43	--	--	--	746.46
1956	--	674.37	66.90	0.49	--	--	--	--	--	741.76
1957	3.12	1,056.16	176.58	3.22	0.22	0.08	--	--	--	1,239.38
1958	0.48	490.88	561.76	5.25	0.90	0.39	--	--	--	1,059.66
1959	10.71	2,058.36	200.20	14.78	--	--	--	--	--	2,284.05
1960	--	142.58	666.94	2.64	--	--	--	--	--	812.16
1961	--	311.76	206.42	197.99	0.32	0.16	--	--	--	716.65
Middle Atlantic:										
1955	--	16.66	513.31	312.26	160.40	12.90	2.34	0.96	0.12	1,018.95
1956	--	190.28	823.35	232.82	18.60	18.19	3.31	0.71	0.13	1,287.39
1957	--	302.78	932.53	58.05	35.72	17.15	13.92	0.40	0.69	1,361.24
1958	--	22.73	850.63	19.75	1.07	0.31	0.17	--	--	894.66
1959	--	994.72	519.71	194.19	5.13	1.02	1.22	0.75	--	1,716.74
1960	--	13.57	1,277.75	16.64	24.42	5.45	2.33	0.51	0.23	1,340.90
1961	--	3.58	187.61	831.67	6.15	5.68	0.83	0.18	0.11	1,035.81
North Atlantic:										
1955	--	--	0.42	23.76	115.10	21.88	7.93	0.92	0.37	170.38
1956	--	--	13.58	77.00	17.41	86.78	13.59	2.73	0.75	211.84
1957	--	1.87	92.66	38.68	33.07	17.69	18.44	2.99	0.50	205.90
1958	--	0.14	49.13	22.87	7.88	6.31	4.80	2.21	0.10	93.44
1959	--	8.28	37.92	103.91	13.58	5.59	5.75	3.18	1.28	179.49
1960	--	--	81.78	38.93	49.04	8.91	2.70	0.65	0.03	182.04
1961	--	--	4.60	118.14	8.21	15.58	1.50	0.33	0.15	148.51
FALL FISHERY										
North Carolina:										
1955	742.32	30.76	51.08	7.32	16.71	2.74	0.39	--	0.10	851.42
1956	36.37	60.42	26.97	37.48	9.36	46.50	7.48	1.03	--	225.61
1957	284.39	12.41	23.30	15.60	20.72	14.74	11.07	0.95	0.08	383.26
1958	104.11	29.34	98.08	19.63	7.20	8.60	4.04	2.48	--	273.48
1959	0.69	6.87	35.99	103.81	18.44	5.75	6.09	0.78	0.54	178.96
1960	58.31	14.32	38.76	22.63	35.17	10.90	4.03	1.32	0.42	185.86
1961	0.25	10.71	45.17	101.90	5.76	10.00	0.62	--	--	174.41

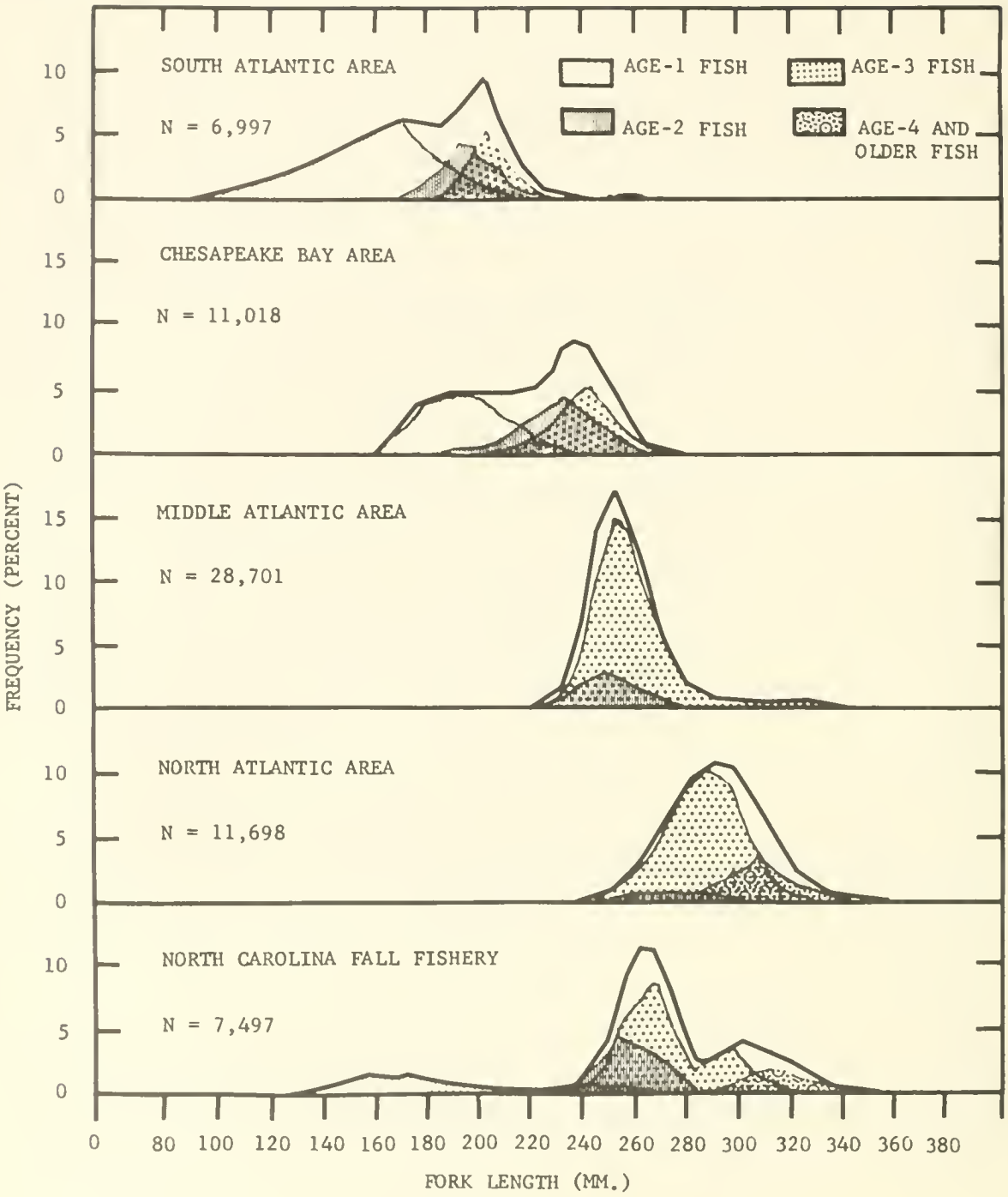

Figure 4.--Length composition of Atlantic menhaden in samples from purse seine catches, 1961.

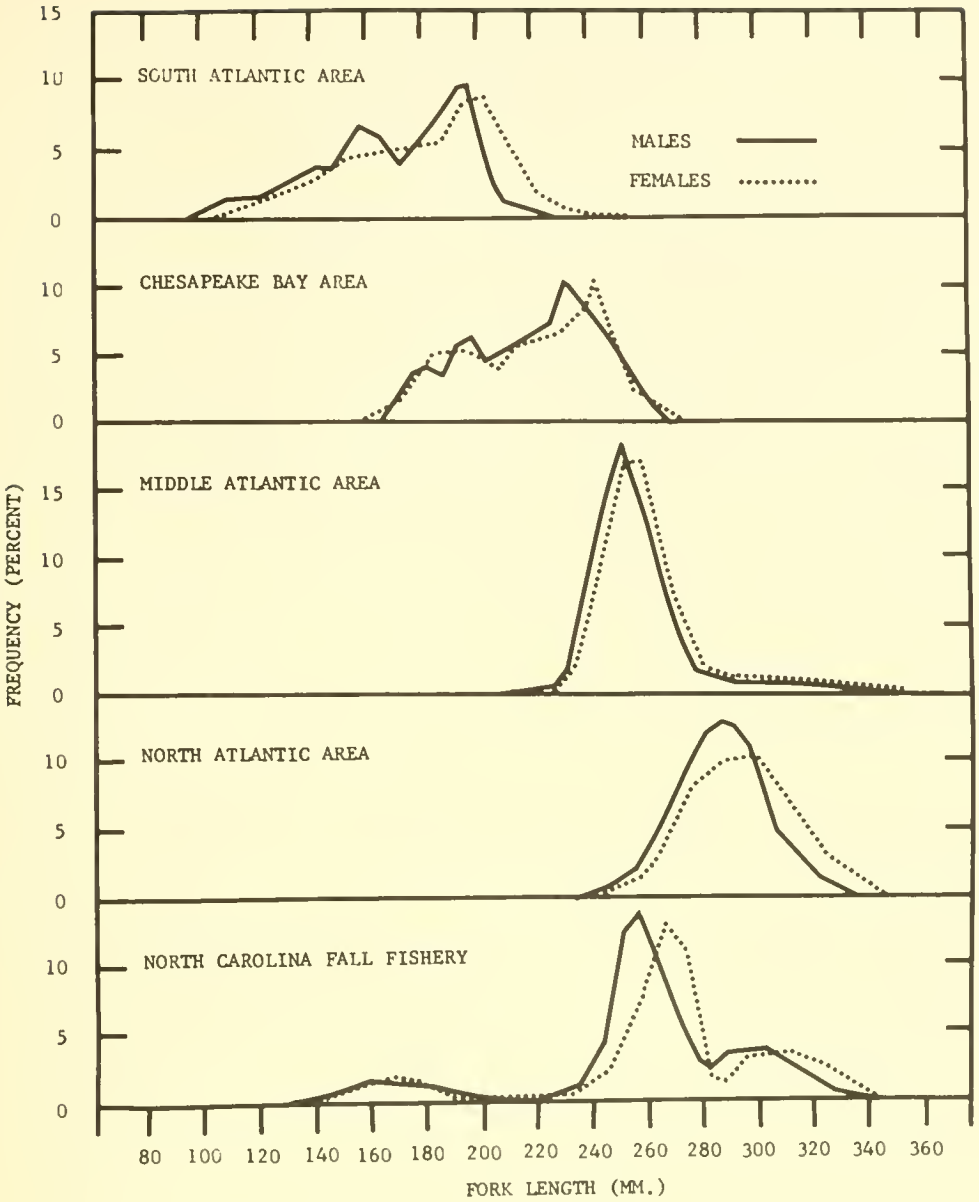

Figure 5.--Length frequencies of male and female Atlantic menhaden in samples from purse seine catches, 1961.

Table 6.--Sex ratio of Atlantic menhaden in purse seine catches, by season and area, 1961

Season and area	Males	Females	Females to males
SUMMER FISHERY	Number	Number	Ratio
South Atlantic.....	642	734	1.14
Chesapeake Bay.....	1,092	1,096	1.00
Middle Atlantic....	2,728	2,924	1.07
North Atlantic.....	1,108	1,161	1.05
FALL FISHERY			
North Carolina.....	726	695	0.96

growth of the tremendously large 1958 year class and the faster growth of the relatively small 1959 and 1960 year classes.

DISCUSSION

The continued dominance of the fishery by the 1958 year class and the relatively poor contributions of the 1959 and 1960 year classes indicate a probable decrease in abundance of Atlantic menhaden in the next few years. Consequently, smaller catches may be expected in 1962 in the Middle and North Atlantic Areas, where age-2 or older fish usually support the fisheries. The larger average size of age-2 and -3 fish will compensate to some extent, however, for their scarcity in

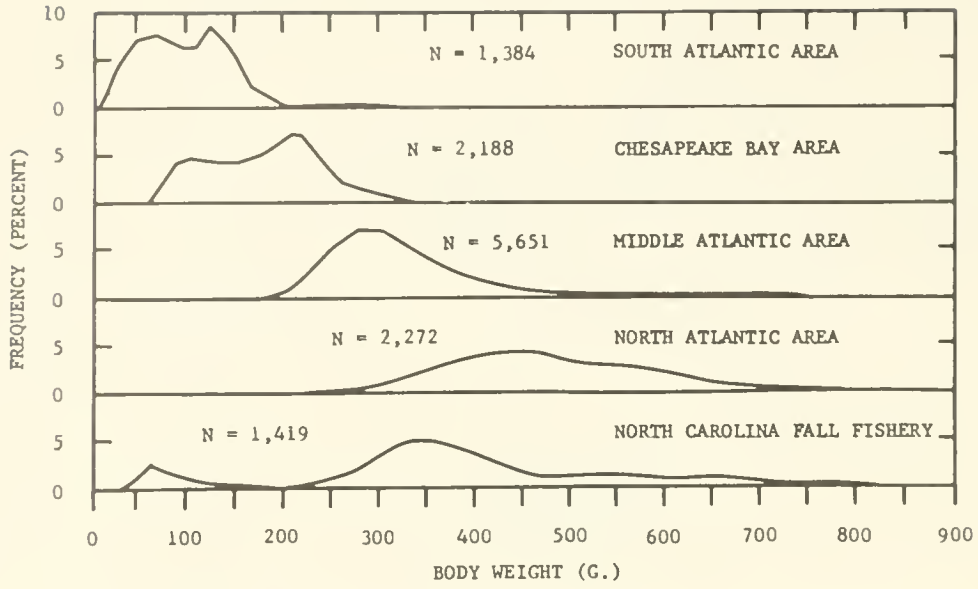

Figure 6.--Weight composition of Atlantic menhaden in samples from purse seine catches, 1961.

Table 7.--Mean fork length (mm.) of Atlantic menhaden in purse seine catches, 1961, and mean of the mean lengths, 1955-60, by age, season, area, and year

Season, area, and year	AGE											Mean
	0	1	2	3	4	5	6	7	8	9	10	
SUMMER FISHERY												
South Atlantic:												
1955-60.....	127	163	192	212	216	--	--	--	--	--	--	170
1961.....	--	160	199	205	219	--	--	--	--	--	--	177
Chesapeake Bay:												
1955-60.....	146	185	218	245	275	268	--	--	--	--	--	194
1961.....	--	194	230	239	285	252	--	--	--	--	--	218
Middle Atlantic:												
1955-60.....	--	210	242	273	302	309	320	324	325	327	--	244
1961.....	--	230	250	258	293	316	326	332	331	--	--	259
North Atlantic:												
1955-60.....	--	217	265	287	306	318	325	330	336	339	344	290
1961.....	--	--	277	286	306	310	325	329	340	339	--	290
FALL FISHERY												
North Carolina:												
1955-60.....	129	190	267	295	310	319	324	328	340	337	--	258
1961.....	150	180	276	273	307	316	329	--	--	--	--	262

Table 8.--Mean weight (g.) of Atlantic menhaden in purse seine catches, 1961, and mean of the mean weights, 1955-60, by age, season, area, and year

Season, area, and year	AGE											Mean
	0	1	2	3	4	5	6	7	8	9	10	
SUMMER FISHERY												
South Atlantic:												
1955-60.....	34	76	122	169	224	--	--	--	--	--	--	88
1961.....	--	72	137	147	203	--	--	--	--	--	--	101
Chesapeake Bay:												
1955-60.....	51	112	175	246	335	347	--	--	--	--	--	129
1961.....	--	128	204	229	393	302	--	--	--	--	--	182
Middle Atlantic:												
1955-60.....	--	174	263	399	537	580	632	650	661	634	--	283
1961.....	--	235	289	324	503	636	690	763	755	--	--	329
North Atlantic:												
1955-60.....	--	180	353	446	544	610	659	690	766	720	774	470
1961.....	--	--	415	458	571	578	664	677	777	741	--	481
FALL FISHERY												
North Carolina:												
1955-60.....	35	125	374	514	600	633	689	708	774	713	--	395
1961.....	55	114	344	415	601	660	734	--	--	--	--	383

numbers. In the Chesapeake Bay Area, where age-1 fish usually supply the greatest share of the catch, the yield will depend on the strength of newly recruited future year classes.

The relative abundance of age-1 fish (1960 year class) in the Chesapeake Bay Area may have been greater than was indicated by the percentage age composition of the catches. About 85 percent of the sets were made near the mouth of the bay, where unusually large numbers of age-2 fish (1959 year class) and age-3 fish (1958 year class) were concentrated. Since the larger, older fish produce more oil and better meal than smaller fish, they may have been exploited selectively in preference to age-1 fish that usually occur farther up the bay. If this is true, the 1960 year class should contribute a greater number of fish in future years than was indicated by its contribution in 1961.

The reasons for the scarcity of fish north of Cape Cod are not clear. Fish taken in this area are always age 3 and older, with fish age 4 and older generally dominant from Massachusetts Bay northward. From the abundance of age-3 fish (1958 year class) elsewhere, one would have expected fish to be plentiful in Cape Cod Bay, but they were not. Environmental factors, such as water temperatures, current patterns, or changes in the food supply may have been responsible for a reduced availability in 1961. It is not possible at this time to predict whether the trend to lower abundance in the areas north of Cape Cod, which began in 1956, will continue and will lead to an eventual collapse of fishing in that locality.

SUMMARY

1. The 1961 purse seine catch of Atlantic menhaden was 619,000 tons, 541,000 tons in the summer fishery and 78,000 tons in the North Carolina fall fishery. The largest portion of the catch was taken in the Middle Atlantic Area and the smallest in the South Atlantic Area.

2. The number of sets increased over 1960 in the South Atlantic and Chesapeake Bay Areas and decreased in all other areas. The mean catch per set remained approximately the same as in recent years in all areas except the North Carolina fall fishery.

3. The most productive fishing grounds were in Chesapeake Bay and the coastal waters from about Ocean City, Md., to Long Island Sound, N.Y. Fish were exceptionally scarce north of Cape Cod, Mass.

4. The 1958 year class (age-3 fish) dominated the fishery for the third consecutive year, accounting for 80 percent of the catch

in the Middle and North Atlantic Areas, 28 percent in the Chesapeake Bay Area, 9 percent in the South Atlantic Area, and 58 percent in the North Carolina fall fishery.

5. Fish older than age 3 continued to constitute only a small percentage of the catch.

6. While age-3 fish were shorter and lighter, age-1 and age-2 fish were longer and heavier than the averages for fish of corresponding ages in previous years.

ACKNOWLEDGMENTS

We extend our sincere appreciation to plant owners and managers, who provided space and facilities and who furnished records of vessel landings, and to the vessel captains and pilots who kept logbook records of their daily fishing activities.

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APPENDIX TABLES

Appendix table 1.--Length-frequency distributions of Atlantic menhaden by age in years and sex in samples from purse seine catches, South Atlantic Area, excluding the North Carolina fall fishery, 1961

(M - male, F - female, T - total, including specimens for which sex was not determined)

Fork length	AGE												Total
	1			2			3			4			
	M	F	T	M	F	T	M	F	T	M	F	T	
Mm.													
95-99.....	1	-	1	-	-	-	-	-	-	-	-	-	1
100-104.....	-	-	-	-	-	-	-	-	-	-	-	-	-
105-109.....	3	5	9	-	-	-	-	-	-	-	-	-	9
110-114.....	13	9	23	-	-	-	-	-	-	-	-	-	23
115-119.....	5	6	11	-	-	-	-	-	-	-	-	-	11
120-124.....	8	11	20	-	-	-	-	-	-	-	-	-	20
125-129.....	10	8	18	-	-	-	-	-	-	-	-	-	18
130-134.....	14	18	32	-	-	-	-	-	-	-	-	-	32
135-139.....	25	21	46	-	-	-	-	-	-	-	-	-	46
140-144.....	17	25	42	-	-	-	-	-	-	-	-	-	42
145-149.....	32	32	65	-	-	-	-	-	-	-	-	-	65
150-154.....	18	35	53	-	-	-	-	-	-	-	-	-	53
155-159.....	33	15	49	-	-	-	-	-	-	-	-	-	49
160-164.....	46	49	95	-	-	-	-	-	-	-	-	-	95
165-169.....	35	32	67	-	-	-	-	-	-	-	-	-	67
170-174.....	40	46	87	-	6	7	-	-	-	-	-	-	94
175-179.....	20	29	49	6	7	13	-	-	-	-	-	-	62
180-184.....	24	17	41	12	7	19	-	-	-	-	-	-	60
185-189.....	20	23	43	19	17	36	4	-	4	-	-	-	83
190-194.....	8	16	24	24	32	56	12	9	21	-	-	-	101
195-199.....	10	10	20	25	30	55	26	22	48	-	-	-	123
200-204.....	6	12	18	15	21	36	41	30	72	-	-	-	126
205-209.....	1	2	3	10	20	31	22	28	50	-	-	-	84
210-214.....	1	1	2	3	9	12	8	27	35	-	-	-	49
215-219.....	-	-	-	2	8	10	5	13	18	-	1	1	29
220-224.....	-	-	-	2	4	6	2	7	9	-	-	-	15
225-229.....	-	-	-	3	-	3	2	-	2	-	-	-	5
230-234.....	-	-	-	-	2	2	-	-	-	-	-	-	2
235-239.....	-	-	-	-	-	-	-	1	1	-	-	-	1
240-244.....	-	-	-	1	1	2	-	-	-	-	-	-	2
245-249.....	1	-	1	1	2	3	2	-	2	-	-	-	6
250-254.....	-	-	-	1	3	4	-	1	1	-	-	-	5
255-259.....	-	-	-	1	2	3	1	1	2	-	-	-	5
260-264.....	-	-	-	1	-	1	-	-	-	-	-	-	1
265-269.....	-	-	-	-	-	-	-	-	-	-	-	-	-
270-274.....	-	-	-	-	-	-	-	1	1	-	-	-	1
Total.....	391	422	819	126	171	299	125	140	266	-	1	1	1,385

Appendix table 2.--Length-frequency distributions of Atlantic menhaden by age in years and sex in samples from purse seine catches, Chesapeake Bay Area, 1961

(M - male, F - female, T - total, including specimens for which sex was not determined)

Fork length	AGE															Total
	1			2			3			4			5			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
Mm.																
154-159.....	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1
160-164.....	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	4
165-169.....	8	10	18	-	-	-	-	-	-	-	-	-	-	-	-	18
170-174.....	27	21	48	1	1	2	-	-	-	-	-	-	-	-	-	50
175-179.....	42	43	85	1	1	2	-	-	-	-	-	-	-	-	-	87
180-184.....	43	50	93	1	-	1	-	-	-	-	-	-	-	-	-	94
185-189.....	35	54	89	2	2	4	-	1	1	-	-	-	-	-	-	94
190-194.....	59	53	112	3	4	7	-	-	-	-	-	-	-	-	-	119
195-199.....	63	49	112	3	3	6	1	-	1	-	-	-	-	-	-	119
200-204.....	39	48	87	4	8	12	6	-	6	-	-	-	-	-	-	105
205-209.....	38	34	72	15	7	22	3	3	6	-	-	-	-	-	-	100
210-214.....	29	30	59	18	23	41	6	6	12	-	-	-	-	-	-	112
215-219.....	22	25	47	30	29	59	15	9	24	-	-	-	-	-	-	130
220-224.....	11	10	21	32	33	65	13	17	30	-	-	-	-	-	-	116
225-229.....	10	6	16	42	45	87	30	15	45	-	-	-	-	-	-	148
230-234.....	4	2	6	49	52	101	62	24	86	-	-	-	-	-	-	193
235-239.....	1	2	3	30	37	67	61	44	105	-	-	-	-	-	-	175
240-244.....	-	-	-	31	42	73	56	70	126	-	-	-	-	-	-	199
245-249.....	-	1	1	21	26	47	48	53	101	-	-	-	-	-	-	149
250-254.....	-	-	-	14	16	30	26	32	58	-	-	-	1	-	1	89
255-259.....	-	-	-	7	11	18	19	18	37	-	-	-	-	-	-	55
260-264.....	-	-	-	2	3	5	6	10	16	-	-	-	-	-	-	21
265-269.....	-	-	-	-	1	1	2	5	7	-	-	-	-	-	-	8
270-274.....	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
275-279.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
280-284.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
285-289.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
290-294.....	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
Total.....	431	443	874	306	345	651	354	307	661	-	1	1	1	-	1	2,188

Appendix table 3.--Length-frequency distributions of Atlantic menhaden by age in years and sex in samples from purse seine catches, Middle Atlantic Area, 1961

(M - male, F - female, T - total, including specimens for which sex was not determined)

Fork length	AGE																								Total
	1			2			3			4			5			6			7			8			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
Mm.																									
210-214.....	2	1	3	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
215-219.....	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
220-224.....	3	3	6	1	-	1	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
225-229.....	3	5	8	7	1	8	4	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
230-234.....	2	1	3	22	12	34	27	11	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75
235-239.....	1	3	4	51	37	88	99	54	153	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	245
240-244.....	2	2	4	59	50	109	247	152	399	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	512
245-249.....	1	1	2	88	73	161	323	301	624	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	788
250-254.....	-	-	-	69	79	148	433	412	845	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	994
255-259.....	-	-	-	50	60	110	362	438	800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	910
260-264.....	-	-	-	24	50	74	260	335	595	4	-	4	-	1	1	-	-	-	-	-	-	-	-	-	674
265-269.....	-	-	-	23	25	48	179	236	415	2	1	3	1	1	2	-	-	-	-	-	-	-	-	-	468
270-274.....	-	-	-	6	12	18	93	180	273	3	2	5	-	1	1	-	-	-	-	-	-	-	-	-	297
275-279.....	-	-	-	3	3	6	38	97	135	4	2	6	1	-	1	-	-	-	-	-	-	-	-	-	148
280-284.....	-	-	-	1	1	2	34	39	73	6	7	13	-	-	-	-	-	-	-	-	-	-	-	-	88
285-289.....	-	-	-	-	4	4	25	33	58	2	3	5	1	-	1	-	-	-	-	-	-	-	-	-	68
290-294.....	-	-	-	-	-	-	21	20	41	1	2	3	1	-	1	-	-	-	-	-	-	-	-	-	45
295-299.....	-	-	-	-	2	2	24	19	43	4	-	4	-	-	-	-	-	-	-	-	-	-	-	-	49
300-304.....	-	-	-	-	-	-	12	17	29	2	3	5	8	4	12	-	-	-	-	-	-	-	-	-	46
305-309.....	-	-	-	-	-	-	10	18	28	3	4	7	6	4	10	-	-	-	-	-	-	-	-	-	45
310-314.....	-	-	-	-	-	-	8	8	16	4	5	9	15	5	20	3	1	4	-	-	-	-	-	-	49
315-319.....	-	-	-	-	-	-	1	7	8	1	5	6	11	7	18	2	3	5	-	-	-	-	-	-	37
320-324.....	-	-	-	-	-	-	-	1	1	-	3	3	7	14	21	2	2	4	-	1	1	-	-	-	30
325-329.....	-	-	-	-	-	-	-	-	-	-	1	1	3	10	13	-	1	1	-	-	-	-	-	-	15
330-334.....	-	-	-	-	-	-	-	2	2	-	2	2	3	4	7	-	2	2	-	1	1	1	-	1	15
335-339.....	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5	2	3	5	1	2	3	-	-	-	13
340-344.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
345-349.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	2
350-354.....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
355-359.....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
Total.....	16	16	32	405	409	814	2,201	2,383	4,584	38	40	78	57	58	115	9	14	23	1	4	5	1	-	1	5,652

Appendix table 4.--Length-frequency distributions of Atlantic menhaden by age in years and sex in samples from purse seine catches, North Atlantic Area, 1961

(M - male, F - female, T - total, including specimens for which sex was not determined)

Fork length	AGE																					Total
	2			3			4			5			6			7			8			9			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
Mm.																									
235-239.....	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
240-244.....	-	1	1	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
245-249.....	-	-	-	6	1	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
250-254.....	4	-	4	17	8	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
255-259.....	2	3	5	24	15	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	44
260-264.....	2	2	4	34	25	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64
265-269.....	5	3	8	58	53	111	-	-	-	3	2	5	-	-	-	-	-	-	-	-	-	-	-	-	124
270-274.....	5	8	13	92	69	163	-	-	-	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	179
275-279.....	3	3	6	98	80	178	2	3	5	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	192
280-284.....	4	5	9	126	99	225	-	3	3	2	1	3	-	-	-	1	-	1	-	-	-	-	-	-	241
285-289.....	6	5	11	133	97	231	1	1	2	1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	248
290-294.....	1	4	5	117	106	223	11	3	14	4	3	7	-	-	-	-	-	-	-	-	-	-	-	-	249
295-299.....	-	3	3	98	106	204	8	6	14	13	2	15	-	-	-	-	-	-	-	-	-	-	-	-	236
300-304.....	-	1	1	48	90	138	14	6	20	17	10	27	2	-	2	-	-	-	-	-	-	-	-	-	188
305-309.....	-	-	-	22	71	93	8	7	15	19	14	33	1	2	3	-	-	-	-	-	-	-	-	-	144
310-314.....	-	-	-	3	39	42	8	21	29	29	20	49	1	2	3	1	-	1	-	-	-	-	-	-	124
315-319.....	-	-	-	4	17	21	2	13	15	16	22	38	2	4	6	-	1	1	-	-	-	-	-	-	81
320-324.....	-	1	1	-	9	9	-	12	12	8	17	25	3	2	5	2	1	3	-	-	-	-	-	-	55
325-329.....	-	-	-	-	2	2	1	1	2	3	16	19	2	5	7	1	2	3	-	1	1	-	-	-	34
330-334.....	-	-	-	-	-	-	1	2	3	2	5	7	-	3	3	-	2	2	-	-	-	-	1	1	16
335-339.....	-	1	1	-	-	-	-	-	-	-	3	3	-	1	1	-	1	1	-	2	2	-	-	-	8
340-344.....	-	-	-	-	-	-	-	1	1	-	2	2	-	-	-	-	1	1	-	-	-	-	-	-	4
345-349.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
Total.....	32	40	72	883	888	1,775	56	79	135	121	122	243	11	19	30	5	9	14	-	3	3	-	1	1	2,273

Appendix table 5.--Length-frequency distributions of Atlantic menhaden by age in years and sex in samples from purse seine catches, North Carolina fall fishery, 1961

(M - male, F - female, T - total, including specimens for which sex was not determined)

Fork length	AGE																					Total
	0			1			2			3			4			5			6			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
Mm.																						
130-134.....	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
135-139.....	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
140-144.....	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
145-149.....	-	-	-	5	2	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
150-154.....	1	1	2	5	7	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
155-159.....	2	-	2	12	12	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
160-164.....	-	-	-	7	6	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
165-169.....	-	-	-	6	8	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
170-174.....	-	-	-	13	11	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24
175-179.....	-	-	-	8	12	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
180-184.....	-	-	-	6	4	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
185-189.....	-	-	-	4	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
190-194.....	-	-	-	3	3	6	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	7
195-199.....	-	-	-	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
200-204.....	-	-	-	2	2	4	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	5
205-209.....	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
210-214.....	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
215-219.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220-224.....	-	-	-	-	1	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2
225-229.....	-	-	-	-	1	1	1	-	1	1	-	1	-	-	-	-	-	-	-	-	-	3
230-234.....	-	-	-	3	-	3	1	-	1	2	1	3	-	-	-	-	-	-	-	-	-	7
235-239.....	-	-	-	3	2	5	7	1	8	-	2	2	-	-	-	-	-	-	-	-	-	15
240-244.....	-	-	-	6	1	7	18	5	23	7	6	13	-	-	-	-	-	-	-	-	-	43
245-249.....	-	-	-	1	-	1	22	11	33	10	3	13	-	-	-	-	-	-	-	-	-	47
250-254.....	-	-	-	1	2	3	42	19	61	49	17	66	-	-	-	-	-	-	-	-	-	130
255-259.....	-	-	-	-	3	3	31	19	50	71	29	100	-	-	-	-	-	-	-	-	-	153
260-264.....	-	-	-	-	1	1	28	25	53	42	55	97	1	-	1	-	-	-	-	-	-	152
265-269.....	-	-	-	-	-	-	13	25	38	51	65	116	-	-	-	-	-	-	-	-	-	154
270-274.....	-	-	-	-	-	-	12	20	32	26	59	85	1	2	3	-	-	-	-	-	-	120
275-279.....	-	-	-	-	-	-	1	13	14	15	36	51	1	-	1	-	-	-	-	-	-	66
280-284.....	-	-	-	-	1	1	1	-	1	14	10	24	-	-	-	-	-	-	-	-	-	26
285-289.....	-	-	-	-	-	-	-	-	-	23	9	32	1	1	2	-	-	-	-	-	-	34
290-294.....	-	-	-	-	-	-	1	1	2	24	18	42	1	-	1	-	-	-	-	-	-	45
295-299.....	-	-	-	-	-	-	1	-	1	19	20	39	2	-	2	2	1	3	-	-	-	45
300-304.....	-	-	-	-	-	-	-	-	-	17	21	38	4	3	7	7	2	9	-	-	-	54
305-309.....	-	-	-	-	-	-	-	-	-	3	19	22	5	1	6	9	3	12	-	-	-	40
310-314.....	-	-	-	-	-	-	-	-	-	5	14	19	5	5	10	8	7	15	-	-	-	44
315-319.....	-	-	-	-	-	-	-	-	-	3	7	10	4	4	8	8	10	18	-	-	-	36
320-324.....	-	-	-	-	-	-	-	-	-	-	1	1	-	4	4	6	6	12	-	-	-	17
325-329.....	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2	1	7	8	1	3	4	15
330-334.....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	6	6	2	1	3	10
335-339.....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	2	3	-	-	-	4
340-344.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
Total.....	4	1	5	89	88	177	181	140	321	382	393	775	25	24	49	42	45	87	3	4	7	1,421

Appendix table 6.--Weight-frequency distributions of Atlantic menhaden by age in years and sex in samples from purse seine catches, South Atlantic Area, excluding the North Carolina fall fishery, 1961

(M - male, F - female, T - total, including specimens for which sex was not determined)

Weight	AGE												Total
	1			2			3			4			
	M	F	T	M	F	T	M	F	T	M	F	T	
G.													
10-19.....	4	4	8	-	-	-	-	-	-	-	-	-	8
20-29.....	25	24	50	-	-	-	-	-	-	-	-	-	50
30-39.....	31	35	66	-	-	-	-	-	-	-	-	-	66
40-49.....	43	48	91	-	-	-	-	-	-	-	-	-	91
50-59.....	45	57	103	-	-	-	-	-	-	-	-	-	103
60-69.....	54	45	100	-	-	-	-	-	-	-	-	-	100
70-79.....	58	49	107	-	1	1	-	-	-	-	-	-	108
80-89.....	42	45	88	1	4	6	-	-	-	-	-	-	94
90-99.....	23	35	58	14	11	25	3	-	3	-	-	-	86
100-109.....	20	27	47	17	17	34	4	2	6	-	-	-	87
110-119.....	14	9	24	26	32	58	12	9	21	-	-	-	103
120-129.....	13	19	33	14	25	39	17	24	41	-	-	-	113
130-139.....	8	13	21	15	21	36	40	22	62	-	-	-	119
140-149.....	4	4	8	9	14	23	17	21	38	-	-	-	69
150-159.....	2	3	5	9	12	21	14	29	44	-	-	-	70
160-169.....	1	2	3	7	9	16	5	9	14	-	-	-	33
170-179.....	-	-	-	1	8	9	5	10	15	-	-	-	24
180-189.....	1	-	1	4	3	8	1	4	5	-	-	-	14
190-199.....	-	-	-	1	2	3	1	5	6	-	-	-	9
200-209.....	-	-	-	-	1	1	1	1	2	-	1	1	4
210-219.....	-	-	-	-	1	1	-	-	-	-	-	-	1
220-229.....	-	-	-	1	-	1	-	1	1	-	-	-	2
230-239.....	-	-	-	-	-	-	-	-	-	-	-	-	-
240-249.....	-	1	1	1	1	2	2	-	2	-	-	-	5
250-259.....	-	1	1	-	1	1	-	-	-	-	-	-	2
260-269.....	1	1	2	1	1	2	-	-	-	-	-	-	4
270-279.....	1	-	1	-	1	1	-	-	-	-	-	-	2
280-289.....	-	-	-	3	2	5	-	-	-	-	-	-	5
290-299.....	-	-	-	1	1	2	1	1	2	-	-	-	4
300-309.....	-	-	-	-	1	1	1	-	1	-	-	-	2
310-319.....	-	-	-	-	-	-	-	-	-	-	-	-	-
320-329.....	-	-	-	1	1	2	1	-	1	-	-	-	3
330-339.....	-	-	-	-	1	1	-	1	1	-	-	-	2
340-349.....	-	-	-	-	-	-	-	-	-	-	-	-	-
350-359.....	-	-	-	-	-	-	-	-	-	-	-	-	-
360-369.....	-	-	-	-	-	-	-	-	-	-	-	-	-
370-379.....	-	-	-	-	-	-	-	-	-	-	-	-	-
380-389.....	-	-	-	-	-	-	-	-	-	-	-	-	-
390-399.....	-	-	-	-	-	-	-	1	1	-	-	-	1
Total.....	390	422	818	126	171	299	125	140	266	-	1	1	1,384

Appendix table 7.--Weight-frequency distributions of Atlantic menhaden by age in years and sex in samples from purse seine catches, Chesapeake Bay Area, 1961

(M - male, F - female, T - total, including specimens for which sex was not determined)

Weight	AGE															Total
	1			2			3			4			5			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																
60-69.....	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	4
70-79.....	13	19	32	1	1	2	-	-	-	-	-	-	-	-	-	34
80-89.....	44	37	81	1	1	2	-	-	-	-	-	-	-	-	-	83
90-99.....	53	46	99	-	-	-	-	-	-	-	-	-	-	-	-	99
100-109.....	37	60	97	2	1	3	-	-	-	-	-	-	-	-	-	100
110-119.....	46	52	98	3	4	7	1	1	2	-	-	-	-	-	-	107
120-129.....	36	40	76	5	5	10	-	-	-	-	-	-	-	-	-	86
130-139.....	50	43	93	2	7	9	4	-	4	-	-	-	-	-	-	106
140-149.....	36	35	71	17	5	22	3	1	4	-	-	-	-	-	-	97
150-159.....	28	25	53	9	10	19	6	7	13	-	-	-	-	-	-	85
160-169.....	33	22	55	18	25	43	4	9	13	-	-	-	-	-	-	111
170-179.....	19	22	41	24	26	50	16	9	25	-	-	-	-	-	-	116
180-189.....	11	18	29	33	33	66	18	7	25	-	-	-	-	-	-	120
190-199.....	9	6	15	42	38	80	28	16	44	-	-	-	-	-	-	139
200-209.....	8	7	15	40	35	75	37	20	57	-	-	-	-	-	-	147
210-219.....	7	4	11	27	42	69	55	33	88	-	-	-	-	-	-	168
220-229.....	-	-	-	23	29	52	43	46	89	-	-	-	-	-	-	141
230-239.....	1	2	3	15	24	39	39	39	78	-	-	-	-	-	-	120
240-249.....	-	-	-	6	10	16	26	31	57	-	-	-	-	-	-	73
250-259.....	-	1	1	7	16	23	17	27	44	-	-	-	-	-	-	68
260-269.....	-	-	-	12	5	17	12	13	25	-	-	-	-	-	-	42
270-279.....	-	-	-	9	10	19	11	9	20	-	-	-	-	-	-	39
280-289.....	-	-	-	5	4	9	14	10	24	-	-	-	-	-	-	33
290-299.....	-	-	-	3	7	10	10	13	23	-	-	-	-	-	-	33
300-309.....	-	-	-	1	2	3	5	10	15	-	-	-	1	-	1	19
310-319.....	-	-	-	1	1	2	5	3	8	-	-	-	-	-	-	10
320-329.....	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	2
330-339.....	-	-	-	-	1	1	-	1	1	-	-	-	-	-	-	2
340-349.....	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	2
350-359.....	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
360-369.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
370-379.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
380-389.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
390-399.....	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
Total.....	431	443	874	306	345	651	354	307	661	-	1	1	1	-	1	2,188

Appendix table 8.--Weight-frequency distributions of Atlantic menhaden by age in years and sex in samples from purse seine catches, Middle Atlantic Area, 1961

(M - male, F - female, T - total, including specimens for which sex was not determined)

Weight	AGE																								Total
	1			2			3			4			5			6			7			8			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																									
150-159.....	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
160-169.....	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
170-179.....	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
180-189.....	1	1	2	5	-	5	3	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
190-199.....	2	-	2	5	-	5	10	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
200-209.....	-	2	2	9	8	17	22	5	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46
210-219.....	4	2	6	14	9	23	31	19	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	79
220-229.....	2	2	4	33	23	56	53	36	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	149
230-239.....	-	-	-	34	23	57	87	56	143	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200
240-249.....	-	1	1	25	24	49	109	69	178	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	228
250-259.....	2	2	4	36	22	58	119	105	224	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	286
260-269.....	1	2	3	24	28	52	133	141	274	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	329
270-279.....	1	1	2	47	30	77	168	156	324	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	403
280-289.....	1	1	2	25	35	60	159	152	311	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	373
290-299.....	-	-	-	26	33	59	133	156	289	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	348
300-309.....	-	1	1	27	29	56	153	180	333	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	391
310-319.....	-	-	-	17	23	40	146	160	306	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	346
320-329.....	-	-	-	14	20	34	142	146	288	4	-	4	-	-	-	-	-	-	-	-	-	-	-	-	326
330-339.....	-	-	-	9	21	30	122	140	262	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	293
340-349.....	1	-	1	6	13	19	90	116	206	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	227
350-359.....	-	-	-	13	14	27	86	111	197	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	225
360-369.....	-	-	-	8	6	14	86	85	171	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	188
370-379.....	-	-	-	10	10	20	45	88	133	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	156
380-389.....	-	-	-	2	7	9	44	74	118	4	-	4	-	-	-	-	-	-	-	-	-	-	-	-	131
390-399.....	-	-	-	5	2	7	51	56	107	1	1	2	-	1	1	-	-	-	-	-	-	-	-	-	117
400-409.....	-	-	-	3	6	9	25	47	72	2	-	2	-	1	1	-	-	-	-	-	-	-	-	-	84
410-419.....	-	-	-	3	3	6	20	42	62	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	72
420-429.....	-	-	-	2	4	6	18	30	48	2	-	2	1	1	2	-	-	-	-	-	-	-	-	-	58
430-439.....	-	-	-	1	5	6	15	36	51	2	2	4	1	-	1	-	-	-	-	-	-	-	-	-	62
440-449.....	-	-	-	1	1	2	14	23	37	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	41
450-459.....	-	-	-	-	3	3	9	17	26	1	3	4	2	-	2	-	-	-	-	-	-	-	-	-	35
460-469.....	-	-	-	-	1	1	8	14	22	2	1	3	1	-	1	-	-	-	-	-	-	-	-	-	27
470-479.....	-	-	-	-	1	1	11	10	21	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	23
480-489.....	-	-	-	-	1	1	10	8	18	1	2	3	1	-	1	-	-	-	-	-	-	-	-	-	23
490-499.....	-	-	-	-	1	1	10	10	20	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	22
500-509.....	-	-	-	-	-	-	4	13	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
510-519.....	-	-	-	-	1	1	9	4	13	1	1	2	1	-	1	-	-	-	-	-	-	-	-	-	17
520-529.....	-	-	-	-	-	-	11	8	19	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	20
530-539.....	-	-	-	-	-	-	10	2	12	1	-	1	2	-	2	-	-	-	-	-	-	-	-	-	15
540-549.....	-	-	-	-	-	-	3	5	8	1	-	1	1	1	2	-	-	-	-	-	-	-	-	-	11
550-559.....	-	-	-	-	-	-	8	3	11	1	1	2	1	-	1	-	-	-	-	-	-	-	-	-	14
560-569.....	-	-	-	-	-	-	5	10	15	1	1	2	3	-	3	-	-	-	-	-	-	-	-	-	20
570-579.....	-	-	-	-	-	-	4	8	12	1	1	2	3	-	3	-	-	-	-	-	-	-	-	-	17
580-589.....	-	-	-	-	-	-	5	3	8	1	-	1	4	-	4	1	-	1	-	-	-	-	-	-	14
590-599.....	-	-	-	-	-	-	1	5	6	-	2	2	1	-	1	-	-	-	-	-	-	-	-	-	9
600-609.....	-	-	-	-	-	-	1	3	4	1	-	1	4	1	5	-	-	-	-	-	-	-	-	-	10
610-619.....	-	-	-	-	-	-	1	5	6	-	1	1	2	3	5	1	1	2	-	-	-	-	-	-	14
620-629.....	-	-	-	-	1	1	2	3	5	1	-	1	3	4	7	-	1	1	-	-	-	-	-	-	15
630-639.....	-	-	-	-	1	1	-	4	4	1	1	2	4	1	5	1	-	1	-	-	-	-	-	-	13
640-649.....	-	-	-	-	-	-	-	4	4	1	2	3	1	3	4	1	-	1	-	-	-	-	-	-	12
650-659.....	-	-	-	-	-	-	-	3	3	-	2	2	1	6	7	-	1	1	-	-	-	-	-	-	13
660-669.....	-	-	-	-	-	-	1	2	3	-	3	3	4	4	8	-	-	-	-	-	-	-	-	-	14
670-679.....	-	-	-	-	-	-	2	1	3	-	1	1	2	1	3	-	1	1	-	-	-	-	-	-	8
680-689.....	-	-	-	-	-	-	-	1	1	-	-	-	6	4	10	1	1	2	-	-	-	-	-	-	13
690-699.....	-	-	-	-	-	-	-	-	-	-	2	2	-	5	5	1	-	1	-	1	1	-	-	-	9
700-709.....	-	-	-	-	-	-	1	-	1	1	1	2	3	4	7	-	2	2	-	-	-	-	-	-	12
710-719.....	-	-	-	-	-	-	-	2	2	-	-	-	-	6	6	1	1	2	-	-	-	-	-	-	10

Appendix table 8.--Continued

(M - male, F - female, T - total, including specimens for which sex was not determined)

Weight	AGE																								Total
	1			2			3			4			5			6			7			8			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																									
720-729.....	-	-	-	-	-	-	1	1	2	-	-	-	1	2	3	-	-	-	-	-	-	-	-	-	5
730-739.....	-	-	-	-	-	-	-	1	1	-	-	-	1	2	3	1	1	2	-	-	-	-	-	-	6
740-749.....	-	-	-	-	-	-	-	-	-	-	1	1	1	2	3	-	1	1	-	-	-	-	-	-	5
750-759.....	-	-	-	-	-	-	-	2	2	-	1	1	1	1	2	-	1	1	-	1	1	1	-	1	8
760-769.....	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	1	-	1	-	-	-	3
770-779.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	2
780-789.....	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	1	1	-	-	-	-	-	-	3
790-799.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
800-809.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
810-819.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
820-829.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
830-839.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
Total.....	16	16	32	405	409	814	2,201	2,383	4,584	38	40	78	57	58	115	8	14	22	1	4	5	1	-	1	5,651

Appendix table 9.--Weight-frequency distributions of Atlantic menhaden by age in years and sex in samples from purse seine catches, North Atlantic Area, 1961

(M - male, F - female, T - total, including specimens for which sex was not determined)

Weight	AGE																					Total
	2			3			4			5			6			7			8			9			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																									
250-259.....	-	-	-	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
260-269.....	-	1	1	5	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
270-279.....	1	-	1	4	3	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
280-289.....	4	-	4	6	3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
290-299.....	-	-	-	9	1	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
300-309.....	-	1	1	10	10	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
310-319.....	-	2	2	13	13	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
320-329.....	3	1	4	22	14	36	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	41
330-339.....	-	1	1	18	17	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36
340-349.....	1	5	6	18	18	36	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	43
350-359.....	1	-	1	26	18	44	-	-	-	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	48
360-369.....	1	4	5	32	26	59	-	-	-	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	66
370-379.....	5	-	5	30	22	52	-	-	-	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	59
380-389.....	-	2	2	46	24	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72
390-399.....	1	1	2	33	33	66	-	-	-	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	71
400-409.....	3	2	5	38	36	75	1	1	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	83
410-419.....	-	-	-	44	37	81	2	-	2	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	84
420-429.....	2	3	5	50	37	88	-	1	1	1	-	1	-	-	-	1	-	1	-	-	-	-	-	-	96
430-439.....	1	-	1	48	27	76	1	-	1	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	82
440-449.....	-	2	2	44	39	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85
450-459.....	2	3	5	45	36	81	3	2	5	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	92
460-469.....	-	3	3	43	40	83	4	-	4	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	93
470-479.....	-	1	1	44	42	86	1	2	3	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	91
480-489.....	3	1	4	44	21	65	3	1	4	6	-	6	-	-	-	1	-	1	-	-	-	-	-	-	80
490-499.....	1	1	2	27	23	50	5	1	6	3	1	4	-	-	-	-	-	-	-	-	-	-	-	-	62
500-509.....	1	-	1	36	30	66	3	2	5	7	3	10	-	-	-	-	-	-	-	-	-	-	-	-	82
510-519.....	-	-	-	26	31	57	2	2	4	5	1	6	-	1	1	-	-	-	-	-	-	-	-	-	68
520-529.....	1	-	1	15	31	46	1	1	2	5	3	8	-	1	1	-	-	-	-	-	-	-	-	-	58
530-539.....	-	-	-	21	23	44	3	2	5	6	2	8	1	1	2	-	-	-	-	-	-	-	-	-	59

Appendix table 9.--Continued

(M - male, F - female, T - total, including specimens for which sex was not determined)

Weight	AGE																							Total
	2			3			4			5			6			7			8			9			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																									
540-549.....	-	-	-	22	20	42	2	5	7	8	10	18	-	-	-	-	-	-	-	-	-	-	-	-	67
550-559.....	1	1	2	9	16	25	4	6	10	9	9	18	1	-	1	-	-	-	-	-	-	-	-	-	56
560-569.....	-	2	2	7	29	36	7	3	10	7	4	11	-	1	1	-	-	-	-	-	-	-	-	-	60
570-579.....	-	-	-	10	25	35	2	5	7	6	5	11	-	-	-	-	-	-	-	-	-	-	-	-	53
580-589.....	-	-	-	2	14	16	4	1	5	9	4	13	-	-	-	-	2	2	-	-	-	-	-	-	36
590-599.....	-	-	-	8	21	29	-	6	6	5	6	11	1	2	3	-	-	-	-	-	-	-	-	-	49
600-609.....	-	-	-	2	24	26	1	7	8	6	8	14	3	-	3	-	-	-	-	-	-	-	-	-	51
610-619.....	-	-	-	4	15	19	1	3	4	3	11	14	-	-	-	-	-	-	-	-	-	-	-	-	37
620-629.....	-	-	-	4	5	9	2	4	6	5	6	11	-	1	1	1	-	1	-	-	-	-	-	-	28
630-639.....	-	-	-	4	8	12	-	4	4	4	5	9	2	-	2	-	-	-	-	-	-	-	-	-	27
640-649.....	-	-	-	3	6	9	-	2	2	2	6	8	-	1	1	1	-	1	-	-	-	-	-	-	21
650-659.....	-	-	-	3	9	12	-	2	2	3	4	7	-	-	-	-	-	-	-	1	1	-	-	-	22
660-669.....	-	1	1	1	7	8	-	3	3	2	4	6	-	1	1	-	-	-	-	-	-	-	-	-	19
670-679.....	-	-	-	2	6	8	-	2	2	1	1	2	-	1	1	-	-	-	-	-	-	-	-	-	13
680-689.....	-	-	-	-	2	2	1	1	2	-	5	5	-	-	-	-	-	-	-	-	-	-	-	-	9
690-699.....	-	1	1	1	6	7	2	1	3	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	12
700-709.....	-	-	-	-	3	3	-	1	1	1	3	4	-	-	-	-	2	2	-	-	-	-	-	-	10
710-719.....	-	-	-	-	1	1	-	2	2	1	1	2	-	-	-	-	1	1	-	-	-	-	-	-	6
720-729.....	-	-	-	-	2	2	1	-	1	-	1	1	-	3	3	-	1	1	-	-	-	-	-	-	8
730-739.....	-	-	-	-	2	2	-	2	2	-	2	2	-	-	-	-	-	-	-	1	1	-	-	-	7
740-749.....	-	1	1	-	3	3	-	2	2	-	1	1	-	-	-	-	-	-	-	-	-	-	1	1	8
750-759.....	-	-	-	-	2	2	-	-	-	-	1	1	1	1	2	-	-	-	-	-	-	-	-	-	5
760-769.....	-	-	-	-	3	3	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	5
770-779.....	-	-	-	-	1	1	-	-	-	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	3
780-789.....	-	-	-	-	2	2	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
790-799.....	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	-	1	1	-	-	-	-	-	-	3
800-809.....	-	-	-	-	-	-	-	-	-	-	1	1	1	-	1	1	-	1	-	-	-	-	-	-	3
810-819.....	-	-	-	-	1	1	-	-	-	-	1	1	-	1	1	-	-	-	-	-	-	-	-	-	3
820-829.....	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	-	-	2
830-839.....	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	-	-	-	-	-	-	2
840-849.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
850-859.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
860-869.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
870-879.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
880-889.....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
890-899.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
900-909.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
910-919.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
920-929.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
930-939.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
940-949.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
950-959.....	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Total.....	32	40	72	882	888	1,774	56	79	135	121	122	243	11	19	30	5	9	14	-	3	3	-	1	1	2,272

Appendix table 10.--Weight-frequency distributions of Atlantic menhaden by age in years and sex in samples from purse seine catches, North Carolina fall fishery, 1961

(M - male, F - female, T - total, including specimens for which sex was not determined)

Weight	AGE																					Total
	0			1			2			3			4			5			6			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																						
30-39.....	1	-	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
40-49.....	-	-	-	1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
50-59.....	-	1	1	7	9	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
60-69.....	3	-	3	19	14	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36
70-79.....	-	-	-	8	9	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
80-89.....	-	-	-	11	10	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
90-99.....	-	-	-	8	12	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
100-109.....	-	-	-	7	5	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
110-119.....	-	-	-	5	4	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
120-129.....	-	-	-	1	1	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	3
130-139.....	-	-	-	1	4	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
140-149.....	-	-	-	3	1	4	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	5
150-159.....	-	-	-	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
160-169.....	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
170-179.....	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
180-189.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
190-199.....	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
200-209.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
210-219.....	-	-	-	-	1	1	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	3
220-229.....	-	-	-	1	1	2	1	-	1	1	1	2	-	-	-	-	-	-	-	-	-	5
230-239.....	-	-	-	-	-	-	1	-	1	1	-	1	-	-	-	-	-	-	-	-	-	2
240-249.....	-	-	-	1	-	1	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	4
250-259.....	-	-	-	3	-	3	3	2	5	1	2	3	-	-	-	-	-	-	-	-	-	11
260-269.....	-	-	-	5	4	9	4	-	4	3	1	4	-	-	-	-	-	-	-	-	-	17
270-279.....	-	-	-	1	-	1	11	2	13	8	1	9	-	-	-	-	-	-	-	-	-	23
280-289.....	-	-	-	1	-	1	7	4	11	7	3	10	-	-	-	-	-	-	-	-	-	22
290-299.....	-	-	-	2	-	2	15	5	20	18	2	20	-	-	-	-	-	-	-	-	-	42
300-309.....	-	-	-	-	-	-	14	5	19	29	8	37	-	-	-	-	-	-	-	-	-	56
310-319.....	-	-	-	-	-	-	13	7	20	19	8	27	-	-	-	-	-	-	-	-	-	47
320-329.....	-	-	-	-	2	2	19	9	28	22	14	36	1	-	1	-	-	-	-	-	-	67
330-339.....	-	-	-	-	-	-	14	10	24	26	15	41	-	-	-	-	-	-	-	-	-	65
340-349.....	-	-	-	-	2	2	15	15	30	18	19	37	-	-	-	-	-	-	-	-	-	69
350-359.....	-	-	-	-	-	-	11	9	20	20	22	42	-	-	-	-	-	-	-	-	-	62
360-369.....	-	-	-	-	-	-	9	8	17	17	18	35	1	-	1	-	-	-	-	-	-	53
370-379.....	-	-	-	-	-	-	7	15	22	18	23	41	-	-	-	-	-	-	-	-	-	63
380-389.....	-	-	-	-	1	1	9	7	16	12	25	37	-	1	1	-	-	-	-	-	-	55
390-399.....	-	-	-	-	-	-	7	9	16	15	13	28	-	-	-	-	-	-	-	-	-	44
400-409.....	-	-	-	-	-	-	8	6	14	9	25	34	-	1	1	-	-	-	-	-	-	49
410-419.....	-	-	-	-	-	-	2	6	8	13	18	31	-	-	-	-	-	-	-	-	-	39
420-429.....	-	-	-	-	-	-	1	6	7	7	19	26	1	-	1	-	-	-	-	-	-	34
430-439.....	-	-	-	-	-	-	3	3	6	10	20	30	-	-	-	-	-	-	-	-	-	36
440-449.....	-	-	-	-	-	-	-	4	4	4	11	15	-	-	-	-	-	-	-	-	-	19
450-459.....	-	-	-	-	-	-	-	4	4	5	4	9	1	-	1	-	-	-	-	-	-	14
460-469.....	-	-	-	-	-	-	-	-	-	6	7	13	-	-	-	-	-	-	-	-	-	13
470-479.....	-	-	-	-	-	-	-	-	-	9	2	11	-	1	1	-	-	-	-	-	-	12
480-489.....	-	-	-	-	-	-	-	1	1	7	8	15	-	-	-	-	-	-	-	-	-	16
490-499.....	-	-	-	-	-	-	-	-	-	11	12	23	-	-	-	-	-	-	-	-	-	23
500-509.....	-	-	-	-	-	-	-	-	-	9	3	12	-	-	-	-	-	-	-	-	-	12
510-519.....	-	-	-	-	-	-	-	-	-	5	2	7	-	-	-	-	-	-	-	-	-	7
520-529.....	-	-	-	-	-	-	1	-	1	12	8	20	1	-	1	1	-	1	-	-	-	23
530-539.....	-	-	-	-	-	-	-	1	1	6	7	13	-	-	-	1	-	1	-	-	-	15
540-549.....	-	-	-	-	-	-	-	-	-	7	8	15	2	-	2	-	-	-	-	-	-	17
550-559.....	-	-	-	-	-	-	-	-	-	3	7	10	1	-	1	2	1	3	-	-	-	14
560-569.....	-	-	-	-	-	-	-	-	-	2	6	8	3	2	5	-	-	-	-	-	-	13
570-579.....	-	-	-	-	-	-	-	-	-	7	11	18	1	1	2	1	-	1	-	-	-	21
580-589.....	-	-	-	-	-	-	1	-	1	3	3	6	-	1	1	6	1	7	-	-	-	15
590-599.....	-	-	-	-	-	-	-	-	-	3	6	9	1	-	1	2	-	2	-	-	-	12

Appendix table 10.--Continued

(M - male, F - female, T - total, including specimens for which sex was not determined)

Weight	AGE																					Total
	0			1			2			3			4			5			6			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																						
600-609.....	-	-	-	-	-	-	-	-	-	1	3	4	1	2	3	2	2	4	-	-	-	11
610-619.....	-	-	-	-	-	-	-	-	-	-	5	5	2	1	3	5	-	5	-	-	-	13
620-629.....	-	-	-	-	-	-	-	-	-	2	3	5	1	1	2	-	1	1	-	-	-	8
630-639.....	-	-	-	-	-	-	-	-	-	-	4	4	2	1	3	2	1	3	-	-	-	10
640-649.....	-	-	-	-	-	-	-	-	-	2	5	7	3	1	4	10	1	11	-	-	-	22
650-659.....	-	-	-	-	-	-	-	-	-	1	2	3	1	1	2	4	3	7	-	-	-	12
660-669.....	-	-	-	-	-	-	-	-	-	-	3	3	-	2	2	1	3	4	1	-	1	10
670-679.....	-	-	-	-	-	-	-	-	-	3	1	4	2	-	2	-	7	7	1	-	1	14
680-689.....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	3	3	-	-	-	4
690-699.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4	-	1	1	5
700-709.....	-	-	-	-	-	-	-	-	-	-	3	3	-	-	-	1	1	2	-	-	-	5
710-719.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	6	-	-	-	6
720-729.....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2	-	-	-	3
730-739.....	-	-	-	-	-	-	-	-	-	-	1	1	-	3	3	-	1	1	-	-	-	5
740-749.....	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	3	3	-	1	1	6
750-759.....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	1	1	3
760-769.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
770-779.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
780-789.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	1	-	1	3
790-799.....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2	-	-	-	3
800-809.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	1
810-819.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
820-829.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
Total.....	4	1	5	89	88	177	181	140	321	382	393	775	25	24	49	41	44	85	3	4	7	1,419

Appendix table 11.--Mean fork length and weight of Atlantic menhaden by age and sex in samples from purse seine catches, South Atlantic Area, excluding North Carolina fall fishery, 1961

(Numbers of fish in parentheses)

Age group	SEX					
	Males		Females		Both sexes	
Fork length (mm.):						
1.....	159.1	(391)	160.2	(422)	159.6	(813)
2.....	197.2	(126)	199.7	(171)	198.6	(297)
3.....	203.4	(125)	207.1	(140)	205.3	(265)
4.....	--		219.0	(1)	219.0	(1)
Weight (g.):						
1.....	71.1	(390)	73.0	(422)	72.1	(812)
2.....	134.9	(126)	138.9	(171)	137.2	(297)
3.....	142.8	(125)	150.2	(140)	146.7	(265)
4.....	--		203.0	(1)	203.0	(1)

Appendix table 12.--Mean fork length and weight of Atlantic menhaden by age and sex in samples from purse seine catches, Chesapeake Bay Area, 1961

(Numbers of fish in parentheses)

Age group	SEX					
	Males		Females		Both sexes	
Fork length (mm.):						
1.....	194.6	(431)	193.7	(443)	194.2	(874)
2.....	228.3	(306)	230.0	(345)	229.2	(651)
3.....	237.1	(354)	240.2	(307)	238.5	(661)
4.....	--		285.0	(1)	252.0	(1)
5.....	252.0	(1)	--		252.0	(1)
Weight (g.):						
1.....	128.7	(431)	126.5	(443)	127.6	(874)
2.....	200.4	(306)	205.8	(345)	203.3	(651)
3.....	223.8	(354)	232.6	(307)	227.9	(661)
4.....	--		393.0	(1)	393.0	(1)
5.....	302.0	(1)	--		302.0	(1)

Appendix table 13.--Mean fork length and weight of Atlantic menhaden by age and sex in samples from purse seine catches, Middle Atlantic Area, 1961

(Numbers of fish in parentheses)

Age group	SEX					
	Males		Females		Both sexes	
Fork length (mm.):						
1.....	227.6	(16)	230.9	(16)	229.2	(32)
2.....	248.3	(405)	252.3	(409)	250.3	(814)
3.....	256.1	(2,201)	259.5	(2,383	257.9	(4,584)
4.....	285.1	(38)	300.3	(40)	292.9	(78)
5.....	312.0	(57)	319.1	(58)	315.6	(115)
6.....	320.4	(9)	329.4	(14)	325.9	(23)
7.....	336.0	(1)	331.5	(4)	332.4	(5)
8.....	331.0	(1)	--		331.0	(1)
Weight (g.):						
1.....	232.1	(16)	235.9	(16)	234.0	(32)
2.....	278.7	(405)	299.3	(409)	289.1	(814)
3.....	315.5	(2,201)	331.3	(2,383)	323.7	(4,584)
4.....	453.5	(38)	550.0	(40)	503.0	(78)
5.....	610.5	(57)	660.7	(58)	635.8	(115)
6.....	661.0	(8)	706.1	(14)	689.7	(22)
7.....	760.0	(1)	763.2	(4)	762.6	(5)
8.....	755.0	(1)	--		755.0	(1)

Appendix table 14.--Mean fork length and weight of Atlantic menhaden by age and sex in samples from purse seine catches, North Atlantic Area, 1961

(Numbers of fish in parentheses)

Age group	SEX					
	Males		Females		Both sexes	
Fork length (mm.):						
2.....	272.4	(32)	280.4	(40)	276.9	(72)
3.....	282.6	(883)	288.5	(888)	285.6	(1,771)
4.....	301.7	(56)	309.5	(79)	306.2	(135)
5.....	306.4	(121)	313.7	(122)	310.1	(243)
6.....	320.8	(11)	326.6	(19)	324.5	(30)
7.....	315.4	(5)	336.6	(9)	329.0	(14)
8.....	--		339.7	(3)	339.7	(3)
9.....	--		339.0	(1)	339.0	(1)
Weight (g.):						
2.....	395.3	(32)	430.8	(40)	415.0	(72)
3.....	438.0	(882)	478.0	(888)	458.1	(1,770)
4.....	534.9	(56)	597.0	(79)	571.2	(135)
5.....	549.5	(121)	605.4	(122)	577.6	(243)
6.....	638.4	(11)	678.8	(19)	664.0	(30)
7.....	598.0	(5)	720.2	(9)	676.6	(14)
8.....	--		776.7	(3)	776.7	(3)
9.....	--		741.0	(1)	741.0	(1)

Appendix table 15.--Mean fork length and weight of Atlantic menhaden by age and sex in samples from purse seine catches, North Carolina fall fishery, 1961

(Numbers of fish in parentheses)

Age group	SEX					
	Males		Females		Both sexes	
Fork length (mm.):						
0.....	149.5	(4)	152.0	(1)	150.0	(5)
1.....	180.8	(89)	180.1	(88)	180.4	(177)
2.....	254.6	(181)	261.3	(140)	257.5	(321)
3.....	269.6	(382)	275.9	(393)	272.8	(775)
4.....	302.3	(25)	311.4	(24)	306.7	(49)
5.....	311.8	(42)	319.9	(45)	316.0	(87)
6.....	330.3	(3)	328.5	(4)	329.3	(7)
Weight (g.):						
0.....	55.2	(4)	52.0	(1)	54.6	(5)
1.....	114.0	(89)	113.8	(88)	113.9	(177)
2.....	331.4	(181)	360.9	(140)	344.3	(321)
3.....	395.9	(382)	433.5	(393)	414.9	(775)
4.....	570.4	(25)	632.5	(24)	600.8	(49)
5.....	625.9	(41)	691.3	(44)	659.7	(85)
6.....	705.7	(3)	755.0	(4)	733.8	(7)

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